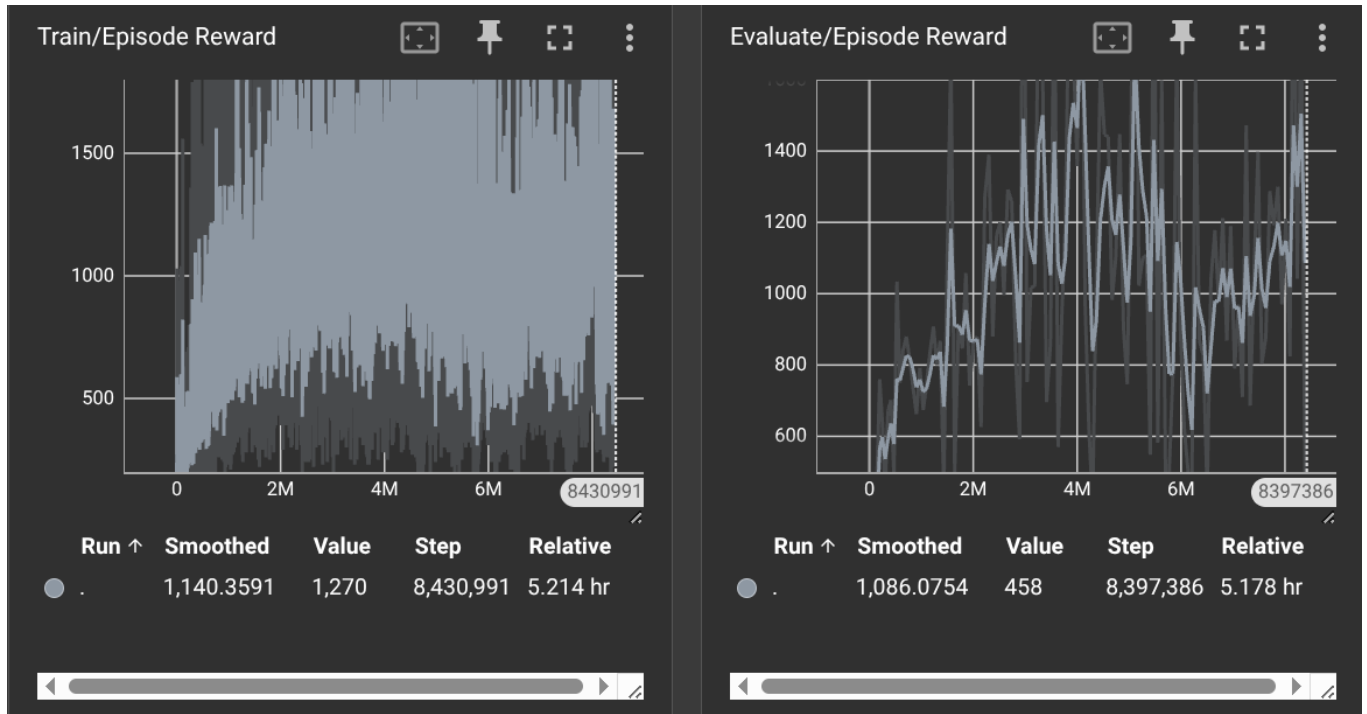


Atari DQN HW2

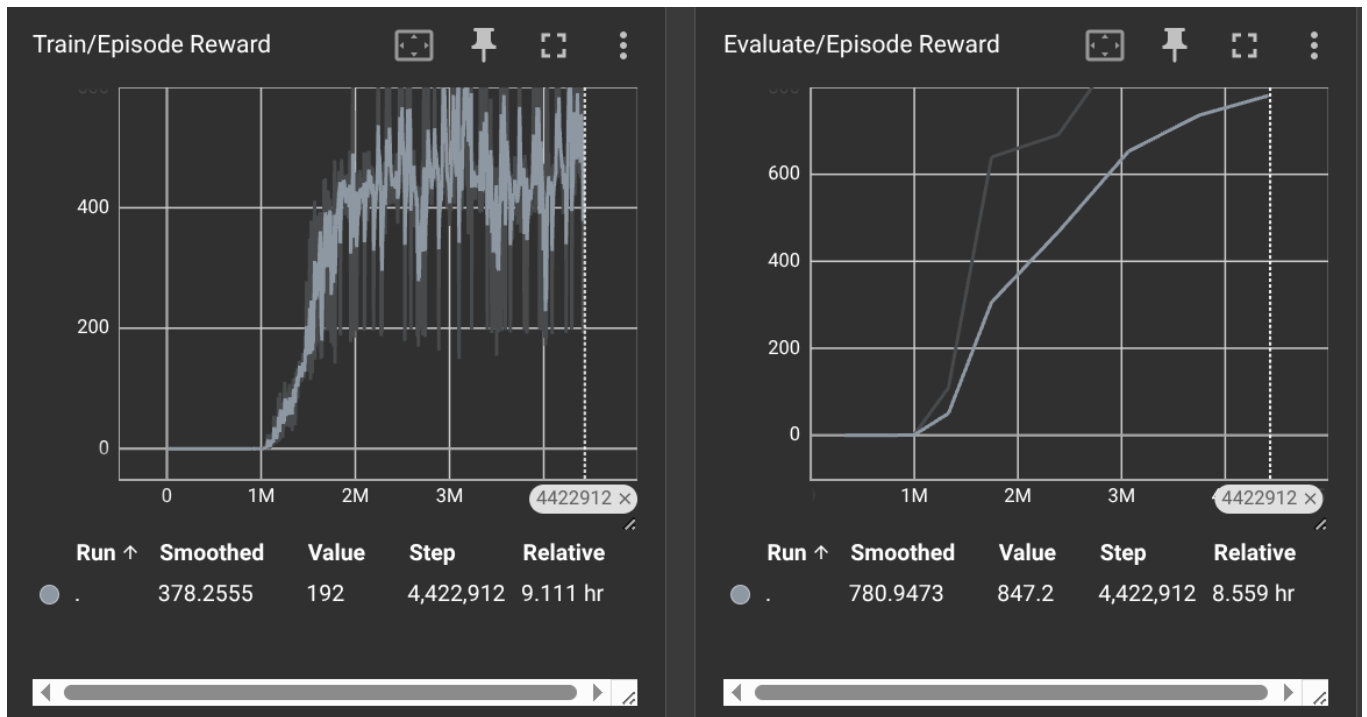
Report

- Screenshot of Tensorboard training curve and testing results on DQN



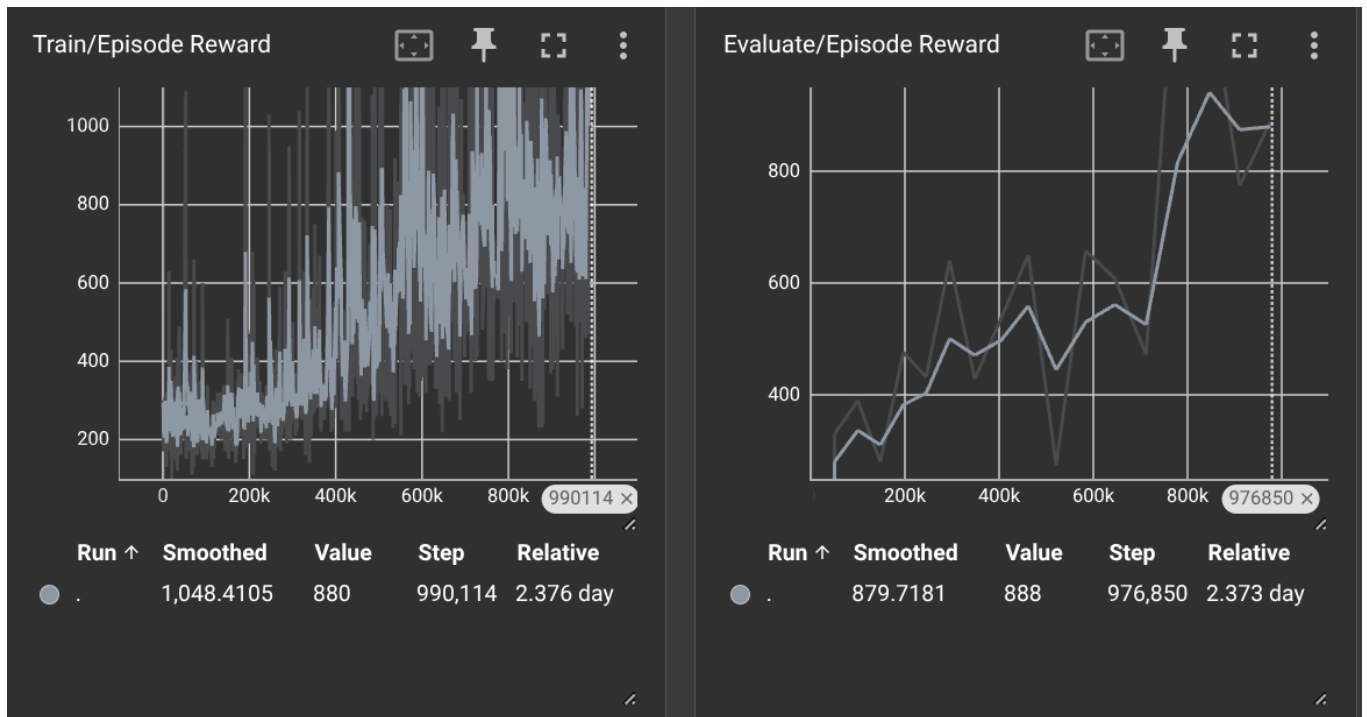
```
episode 1 reward: 1400.0
episode 2 reward: 1150.0
episode 3 reward: 730.0
episode 4 reward: 880.0
episode 5 reward: 1200.0
average score: 1072.0
```

- Screenshot of Tensorboard training curve and testing results on **Enduro-v5** using DQN



```
episode 1 reward: 787.0
episode 2 reward: 452.0
episode 3 reward: 1021.0
episode 4 reward: 1033.0
episode 5 reward: 701.0
average score: 798.8
```

- Screenshot of Tensorboard training curve and testing results on DDQN, and discuss the difference between DQN and DDQN



```

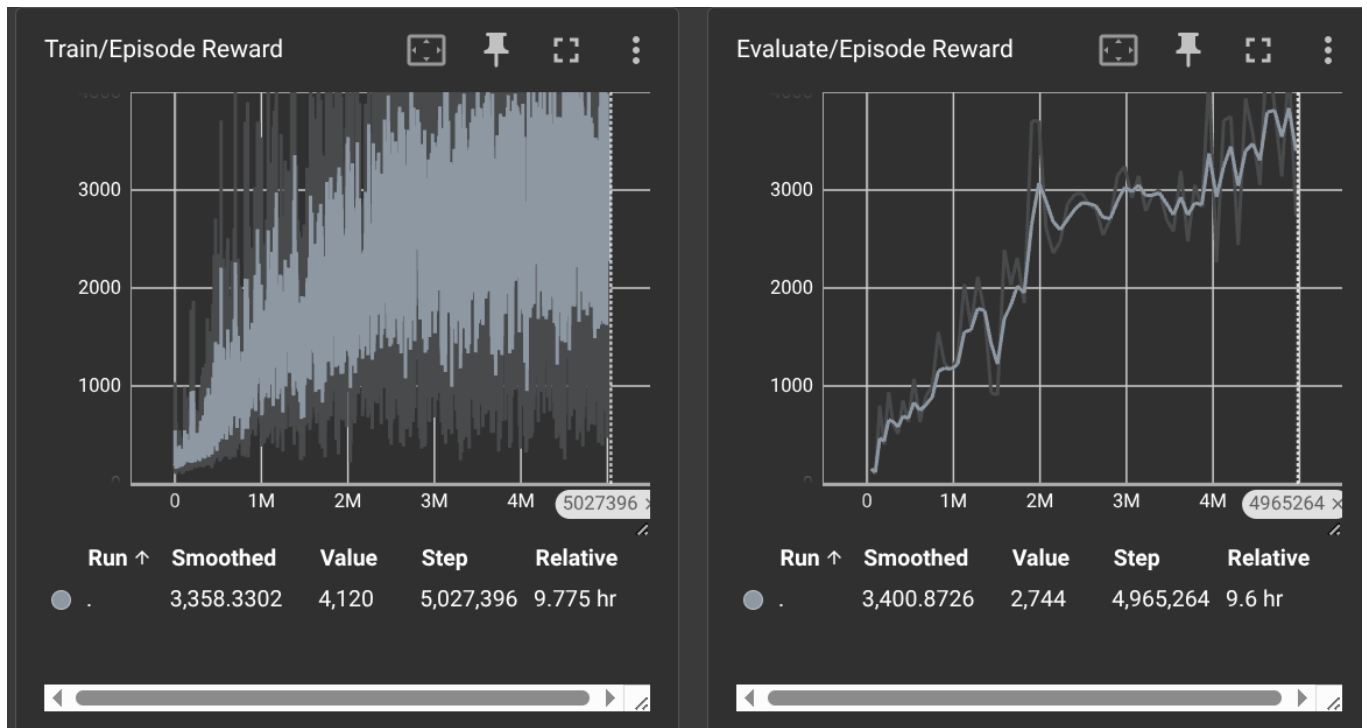
episode 1 reward: 1330.0
episode 2 reward: 2220.0
episode 3 reward: 3360.0
episode 4 reward: 1560.0
episode 5 reward: 1370.0
average score: 1968.0

```

– Discussion

DQN overestimates Q-values since one network selects and evaluates actions. DDQN separates these roles, reducing bias and yielding smoother, more stable learning.

- Screenshot of Tensorboard training curve and testing results on Dueling DQN, and discuss the difference between DQN and Dueling DQN



```

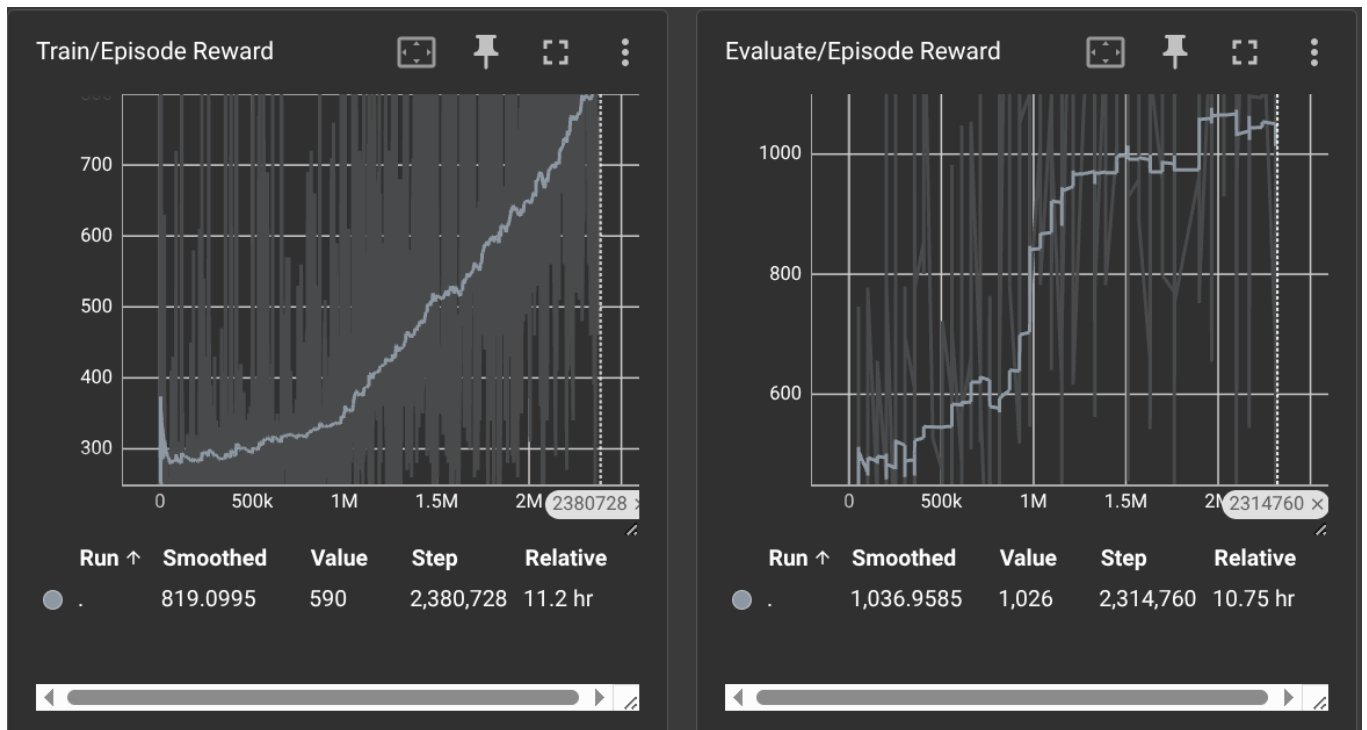
episode 1 reward: 3010.0
episode 2 reward: 4050.0
episode 3 reward: 4830.0
episode 4 reward: 4530.0
episode 5 reward: 2830.0
average score: 3850.0

```

– Discussion

Dueling DQN splits Q-values into state-value and advantage, improving representation and efficiency. It outperforms vanilla DQN, especially where many actions are irrelevant.

- Screenshot of Tensorboard training curve and testing results on DQN with parallelized rollout, and discuss the difference between DQN and DQN with parallelized rollout



for max smooth

```
episode 1 reward: 2450.0  
episode 2 reward: 3920.0  
episode 3 reward: 3480.0  
episode 4 reward: 2080.0  
episode 5 reward: 1220.0  
average score: 2630.0
```

– Discussion

Parallelized rollout runs multiple environments, giving diverse, uncorrelated samples. This speeds training and yields smoother, more stable reward curves than standard DQN.